
Future Direction

Introduction

During FY 00, the SITE Program continued to emphasize the importance of first selecting a site and, secondly, evaluating one or more appropriate innovative technologies. The selection of these sites and technologies is important in meeting the needs of those responsible for selecting and implementing hazardous waste cleanup.

Over the past four years, 24 four sites and 30 technologies have been selected under the host site solicitation. A wide range of representation ensures that the most pressing issues are prioritized and addressed. These sites were selected by a review group comprised of representatives from the following organizations:

- DOD Environmental Security and Technology Certification Program (ESTCP)
- DOE Office of Science and Technology
- EPA Office of Solid Waste and Emergency Response
- EPA Regional Offices
- Interstate Technology and Regulatory Cooperation (ITRC) Workgroup

The selected projects are a mix of biological and physical/chemical treatment processes, and the majority involve in situ treatment.

In response to stakeholders demand, the MMT Program initiated a series of demonstrations designed to evaluate innovative sampling and analysis technologies. In FY 98, soil and soil gas sampling technologies were evaluated. In FY 99, a field demonstration of sediment sampling technologies was conducted. In FY 00, the program investigated the applicability of seven TPH measurement devices. These projects are designed to address ongoing

difficulties in obtaining representative samples at defined depths, or obtaining accurate analytical results using less expensive and less complex equipment.

Technology Areas of Primary Interest

The areas of primary interest remain an important part of appropriate site selection. Stakeholder groups, like those used in selecting the sites and technologies, identify these areas with technical staff within ORD. This helps ensure that the most pressing needs are met.

In FY 00 the SITE Program continued to emphasize the need for technologies capable of in situ remediation of dense non-aqueous phase liquids (DNAPLs) in difficult geological formations. This continues to be a theme through the remediation community as a whole. The program continues to evaluate in situ thermal and chemical oxidation type technologies under a broad array of geological conditions. In addition effective remediation technologies for metals in soils, treatment of recalcitrant compounds, and the general need for in situ treatment remain high on the priority list.

Because of technical difficulties related to sediment remediation, this is another area where the remediation community would benefit from new processes, approaches or less expensive methods for treatment. In situ treatment, sampling, and containment are technology areas of interest to be addressed by both the MMT and Demonstration Programs. An increase of projects in these areas is expected in the future. Tables 4 and 5 outline the site priority and contaminant areas of interest of the SITE Program, and Table

6 describes the demonstrations that are planned for FY 01.

MMT Program Areas of Interest

Emerging field analytical areas which will be included in the MMT Program include in situ monitoring technologies, especially for ground water. Specific areas of interest include detection of DNAPLs, chemical sensors for detection of VOCs, geophysical tools for detection of contaminants and subsurface hydrogeologic characteristics, and the reevaluation of field portable x-ray fluorescence. The benefit in testing non-invasive techniques for site characterization is the claimed ability of a variety of geophysical techniques to map a DNAPL plume without the need for drilling wells. Evaluation of geophysical technologies will be very complex and will likely be conducted at controlled spill facilities.

There are a number of biological tests for toxicity in soils and water that are relevant to ecological risk assessment, and that may be useful in waste water and drinking water treatment facilities. A demonstration is planned for FY 01 in order to evaluate the effectiveness of new biological assessment techniques that may be highly sensitive and inexpensive test methods.

Since the program has matured, a number of developers in the area of X-ray fluorescence and gas chromatography / mass spectrometry have made significant improvements in their technology and will be candidates for abbreviated demonstrations which will evaluate the improvements.

Partnerships for Success

Federal to Federal Interface

The SITE Program recognizes the importance of cooperation between federal agencies to find common areas of need and interest. Federal to federal interface is an important aspect to enhancing the benefits of technology demonstrations. It allows for leveraging resources, expedited cost and

performance information exchange and cross fertilization of technical expertise between agencies. In addition this type of collaboration encourages the use of innovative approaches by federal end users in a more expedited manner and has resulted in implementation at other site locations. In common environmental areas of interest this type of joint research is of great benefit to all parties involved.

One example of this type of approach is the Interagency DNAPL Consortium (IDC). The IDC at the Cape Canaveral site is comprised of EPA, DOE, DOD, and NASA. The objective of the group is to conduct side-by-side demonstrations of 3 innovative technologies for DNAPL remediation. The demonstration is being conducted at Cape Canaveral Air Station Launch Complex 34. In FY 2000, 2 technologies have been demonstrated and the third was scheduled to begin demonstration in the summer of FY 01.

DNAPL remediation in the subsurface, particularly in more complex geological conditions, remains a priority area for EPA as well as other federal agencies. The SITE Program is carrying out multiple field demonstrations in a variety of geological formations. This approach parallels the theme set in the 1997 National Research Council (NRC) report titled *Innovation in Groundwater and Soil Cleanup* (www.NAP.EDV/readingroom ISBN #0309-06358-2). A roadmap of the SITE demonstration based on the NRC study is presented in Table 7. In FY 01 - 02 the SITE program will be focusing on the more difficult to treat geological formations such as fractured bedrock. This will be the nation's first large scale attempt to address residual DNAPL residual in fractured media. It is expected that different types of technologies may be needed to treat varying complex formations. These joint projects could potentially identify several innovative options or approaches to solve environmental problems where currently no solutions exists.

Table 4. Future Site Priority Areas 2000 - 2005

Mining Issues/Acid Mine Drainage Manufactured Gas Plants Sediments Wood Treating Pesticide Manufacturers/Formulators
--


Table 5. Future Contaminant Emphasis Areas 2000 - 2005

Groundwater/Soils	Sediments
DNAPL/ Chlorinated Solvents PCBs Arsenic, Mercury or other Heavy Metals	Pesticides PCBs PAHs Arsenic, Mercury, or other Heavy Metals

Table 6. SITE Program Projects FY 01

Site Name/ Location	Technology	Project Description	Proposed Schedule
Jones Island CDF Milwaukee Harbor	Phytoremediation	Treatment of sediments contaminated with PAHs, PCBs for beneficial reuse	Field demonstration FY 01-03
Fox River Superfund Site	Thermal Treatment	PCB contaminated sediment treatment for beneficial reuse	Field demonstration Spring FY 01
Summitville, CO	Multiple innovative passive drainage techniques	Treatment of acid mine drainage	Demonstration FY01-03
Sulphur Bank Mercury Mine Clear Lake, CA	Chemical stabilization	Stabilization of mercury mining waste	Column and humidity testing FY 01
Rocky Mountain Arsenal	In situ biological enhancement	Treatment of organic contaminants with hydrogen release compounds	Demonstration FY01-02
Rocky Mountain Arsenal	In situ heat	Treatment of Hexachlorocyclopentadiene soil contamination	Demonstration FY01-02
Edwards AFB	In situ steam	DNAPL Treatment in fractured bedrock	Field demonstration FY01-02
Cape Canaveral Cocoa Beach, FL	In situ steam	Groundwater and soils contaminated with TCE	Technology demonstration FY 01-02
Loring AFB Aroostook, ME	In situ steam	DNAPL treatment in fractured bedrock	Demonstration to begin summer FY 01
Pearl Harbor Naval Base	Multiple in situ capping techniques	Evaluate biological and stabilization/detoxification techniques	Demonstration planning to begin summer FY 01
Pearl Harbor Naval Base	Electrokinetics	Mobilization and extraction of lead	Demonstration summer FY01

Table 7. DNAPL Testing Site Roadmap: Media (Based on NRC Report, 1997)

More Difficult	Media	Location	Contaminant	Technology
	Clay/Fractured soil and bedrock	Edwards AFB	TCE	Steam injection
		Loring AFB	PCE/TCE	Steam injection
	Heterogeneous (saturated)	Roosevelt Mills, Vernon, CT	PCE/TCE	In Situ oxidation
	Heterogeneous (unsaturated)			
	Fine grained soil (saturated)	Pearl Harbor	Fuel	Surfactant flush
	Coarse/medium grained (saturated)	Port of Ridgefield, Washington State	Creosote	Steam injection
	Fine (unsaturated)	Cape Canaveral	TCE	Resistive heating
				Dynamic underground stripping
				In situ oxidation
	Coarse/Medium grained (unsaturated)			
Less Difficult				

Federal to State Interface

Where there are common environmental areas of interest, cooperation between federal and state agencies and cooperation within the federal government are essential. The ITRC provides a mechanism to interact with multiple state regulatory agencies and state specific verification programs. Direct interaction with multiple state agencies provides many benefits to the SITE Program. State regulatory agencies are also faced with the difficult problems associated with hazardous waste clean-up. In addition, the acceptance of the results of a technology evaluation in one state may not be readily accepted by other states due to the variation of environmental regulations between states. Thus, interaction among multiple states on SITE projects can help overcome this challenge by bringing state agencies together at the onset of the project. This planning process enables the SITE program to address technical issues and questions from numerous states in one field demonstration.

Working cooperatively with multiple states also promotes efficiency in program spending by avoiding duplication of efforts. With this way of planning a project, technical issues and questions from numerous states can be addressed in one field demonstration and duplication of efforts is avoided.

The ITRC currently has several workgroups that crosscut the SITE Program's environmental priority areas of interest. The various groups are as follows: 1) Passive Barrier Workgroup, 2) DNAPL Workgroup, 3) Phytoremediation Workgroup 4) Sediment Workgroup. These groups are invited to participate in SITE Program demonstration projects. Groups choose to participate at a level required by the objectives of the workgroup. Involvement of the workgroups allows for better planning and exchange of technical requirements early in the project planning.

Information Transfer

Information transfer is accomplished through a number of mechanisms. While the Internet information distribution is an effective mechanism, published documentation, meetings, and conferences remain an essential part of technical information dissemination. Coordination with existing remediation workgroups and programs is also essential. The SITE Program continues to work cooperatively with numerous programs, such as DOD's ESTCP Program, the Environmental Council of States (ECOS) sponsored ITRC, and as stated previously plans a much stronger technical relationship with the DOE's Office of Science and Technology.

Internet service allows for quick and easily accessible information, and saves time and costs in publication. The SITE Program converted all earlier publications to electronic format and has made those documents available through the SITE homepage. General program information is available as well as quarterly reports, most recent documents, program highlights and the technology profiles of the vendors participating in the program. As a result of the homepage, the number of documents printed has been reduced by 75%. According to Web Server Statistics, the monthly average

number of hits for electronic information solicited from the SITE homepage over the last year was 1353. Numerous requests come from outside the US, reflecting an increased global interest in the SITE Program.

In addition, one of the most requested documents, the SITE Technology Profiles, is now available in a CD-ROM format with strong search capabilities. This document is updated periodically and new ways for making it more user friendly and more easily accessible will continue to be explored.

The program will continue pursuing and supporting the development of document summaries in areas where data exists on a variety of technologies or applications. The information is useful in providing the user community with comparative technical information and costs within an area. Documentation will continue for some time since many of the technologies are in situ and highly complex. In situ technology evaluations are tested over varying lengths of time, with a minimum time of 3-6 months. Most are evaluated for one year. In the case of phytoremediation, growing seasons span 2-3 years. The summaries will need updating as the technologies mature and information becomes available.



<http://www.epa.gov/ORD/SITE>